CURRENT STATUS OF CLAIMS

1. (ORIGINAL) A detection system comprising:

a chamber for holding culture media, the chamber comprising a cellular attachment surface; and

a detector disposed in the chamber comprising a piezoelectric substrate surface-modified with a binding agent for binding the target substance and a pair of electrodes coupling the piezoelectric substrate to an operating system,

wherein the detection system is configured to detect interaction of the target substance with the binding agent.

2. (ORIGINAL) The system of claim 1, further comprising a second chamber for processing a sample for detection, wherein the second chamber is in fluid communication with the detector.

3. (ORIGINAL) The system of claim 1, wherein the operating system processes acquired data and controls the detection system.

4. (ORIGINAL) The system of claim 1, wherein detection occurs in a liquid or gaseous phase.

5. (ORIGINAL) The system of claim 1, wherein the system is in fluid communication with a water distribution system or a heating, ventilating and air-conditioning system.

6. (ORIGINAL) The system of claim 1, wherein detection of the target substance by the sensor system triggers a notification event.

7. (ORIGINAL) The system of claim 6, wherein the notification event is based on a response algorithm that transmutes the binding event into a signal relayed to a central operating and control system.

8. (ORIGINAL) The system of claim 7, wherein the signal is transmitted wirelessly.

9. (ORIGINAL) The system of claim 8, wherein the system is in communication with a distributed computer network.

10. (ORIGINAL) The system of claim 1, wherein the system is in gaseous communication with a water distribution system or a heating, ventilating and air-conditioning system, a wall cavity, or an enclosed living space.

11. (ORIGINAL) The system of claim 1, wherein detection of the target substance triggers disinfection, decontamination, or removal of the target system.

12. (ORIGINAL) The system of claim 11, wherein the a disinfecting amount of ultraviolet light is delivered to the chamber in which the target substance is detected.

13. (ORIGINAL) The system of claim 1, wherein the detector is selected from an optical detection device, MEMS detection device, cantilevers and micromachined resonating structures, nanoparticle detection device, quantum dots or quantum piezoelectric dots, spectroscopic techniques or an acoustic wave detection device.

14. (ORIGINAL) The system of claim 13, wherein the MEMS detection device comprises cantilevers, micromachined resonating structures or nanoparticle detection device.

15. (ORIGINAL) The system of claim 14, wherein the nanoparticle detection device quantum dots or quantum piezoelectric dots.

16. (ORIGINAL) The system of claim 1, wherein the target substance comprises a growth factor, differentiation inducing factor, polypeptide, vitamin, cofactor, nucleic acid, fatty acid, lipid, carbohydrate, or a combination thereof.

17. (ORIGINAL) The system of claim 1, wherein the binding agent comprises a polypeptide, enzyme, nucleic acid, carbohydrate, lipid, a fragment thereof, or a combination thereof.

18. (ORIGINAL) The system of claim 17, wherein the binding agent comprises an antibody or a fragment thereof.

19. (ORIGINAL) The system of claim 1, wherein system is configured to detect the target substance in real-time.

20. (ORIGINAL) The system of claim 1, wherein the system comprises more than one detector.

21. (ORIGINAL) The system of claim 1, wherein the piezoelectric substrate is surface-modified with at least two binding agents specific for different target substances.

22. (ORIGINAL) The system of claim 20, wherein at least one detector comprises a binding agent that is not specific for the target substance.

23. (ORIGINAL) The system of claim 1, wherein the chamber comprises a cover having at least one port.

24. (ORIGINAL) The system of claim 23, wherein the port provides fluid communication between the chamber and a reservoir.

25. (ORIGINAL) The system of claim 24, wherein the reservoir comprises culture media, growth factors, differentiation inducers, pH buffer, antibiotics, or a combination thereof.

26. (ORIGINAL) The system of claim 1, wherein the operating system comprises a computer, controller, processor, user interface, printer, monitor, power source, oscillator, software, or a combination thereof.

27. (ORIGINAL) The system of claim 1, wherein the cellular attachment surface comprises a membrane, polymer, thermoplastic, plastic, collagen, metal, glass, mesh, fabric, scaffold, or a combination thereof.

28. (ORIGINAL) A method for culturing cells, comprising:

incubating cells in a chamber containing culture media, the chamber comprising a cellular attachment surface;

detecting a target substance in the culture media with a detector disposed in the chamber, wherein the detector is surface-modified with a binding agent for binding a target substance; and

modifying culture conditions based on the presence or absence of the target substance detected in the culture media.

29. (ORIGINAL) The method of claim 28, wherein the detector comprises a piezoelectric substrate surface-modified with a binding agent for binding the target substance and a pair of electrodes coupling the piezoelectric substrate to an operating system.

30. (ORIGINAL) The method of claim 28, wherein the detector is selected from the group consisting of an optical detection device, MEMS detection device, nanoparticle detection device, and an acoustic wave detection device

31. (ORIGINAL) The method of claim 28, wherein the cells are eukaryotic, prokaryotic or achaebacterial.

32. (ORIGINAL) The method of claim 31, wherein the eukaryotic cells are plant cells or animal cells.

33. (ORIGINAL) The method of claim 28, wherein the operating system automatically modifies culture conditions based on the presence of absence of the target substance in the culture media.

34. (ORIGINAL) The method of claim 33, wherein the culture conditions are modified by adding a growth factor, differentiation inducing factor, cell adhesion factor, enzyme, lipid, carbohydrate, polypeptide, polynucleotide, antibiotic, pH buffer, acid, base, or a combination thereof.

35. (ORIGINAL) The method of claim 33, wherein the culture conditions are modified by adjusting cell culture temperature.

36. (ORIGINAL) The method of claim 28, wherein the cells are cultured under physiological conditions.

37. (ORIGINAL) The method of claim 28, wherein the cells comprise embryonic cells.

38. (ORIGINAL) A method for selecting cells comprising:

incubating cells in a chamber containing culture media, the chamber comprising a cellular attachment surface;

detecting a target substance in the culture media with a detector disposed in the chamber, wherein the detector is surface-modified with a binding agent for binding a target substance; and

selecting the cells in which the target substance is detected.

39. (ORIGINAL) The method of claim 38, wherein the detector comprises a piezoelectric substrate surface-modified with a binding agent for binding the target substance and a pair of electrodes coupling the piezoelectric substrate to an operating system.

40. (ORIGINAL) The method of claim 38, wherein the detector is selected from the group consisting of an optical detection device, MEMS detection device, nanoparticle detection device, and an acoustic wave detection device.

41. (ORIGINAL) The method of claim 38, wherein the target substance is present in the culture media or on a cell surface.

42. (ORIGINAL) The method of claim 38, wherein the target substance is a growth factor, polypeptide, polynucleotide, carbohydrate, differentiation inducing factor, neurotransmitter, lipid, cell surface protein, vitamin, intracellular component, or a combination thereof.

43. (ORIGINAL) The method of claim 38, wherein the cells are eukaryotic, prokaryotic or achaebacterial cells.

44. (ORIGINAL) The method of claim 43, wherein the eukaryotic cells are plant cells or animal cells.

45. (ORIGINAL) The method of claim 38, wherein the cells comprise embryonic cells.

46. (ORIGINAL) The method of claim 38, wherein the target substance is detected in real-time.

47. (ORIGINAL) The method of claim 38, wherein the detector comprises at least two binding agents each specific for a different target substance.

48. (ORIGINAL) A method for selecting cultures comprising:

monitoring culture media content of at least one cell culture with at least one detector disposed in each of the at least one cell cultures, wherein the at least one detector comprises a surface modified with a binding agent specific for at least one target substance; and

selecting the cell culture in which the at least one target substance is detected.

49. (ORIGINAL) The method of claim 48, wherein the detector comprises a piezoelectric substrate surface-modified with at least one binding agent for binding at least one target substance and a pair of electrodes coupling the piezoelectric substrate to an operating system,

50. (ORIGINAL) The method of claim 48, wherein the detector is selected from the group consisting of an optical detection device, MEMS detection device, nanoparticle detection device, and an acoustic wave detection device.

51. (ORIGINAL) The method of claim 48, wherein the target substance is a biomolecule.

52. (ORIGINAL) The method of claim 48, wherein the target substance is correlated with a growth stage of the cell culture, differentiation event of the cell culture, or ability of the cell culture to produce a specific tissue, specific cell type, or extracellular matrix.

53. (ORIGINAL) The method of claim 48, wherein the target substance is secreted by at least one cell in the cell culture or displayed on a surface of at least one cell in the cell culture.

54. (ORIGINAL) The method of claim 48, wherein at least one cell of the cell culture undergoes mitosis.

55. (ORIGINAL) The method of claim 48, wherein the target substance interacts with the binding agent to modulate a resonance frequency of the piezoelectric substrate.

56. (ORIGINAL) A system for detecting one or more target substances comprising:

(a) a piezoelectric substrate disposed in a culture chamber;

(b) a first and a second binding agent attached to a surface of the piezoelectric substrate, wherein the first binding agent specifically binds a first target substance and the second binding agent specifically binds a second target agent;

(c) an input transducer for converting an electric field into an acoustic wave and an output transducer for converting the acoustic wave to an electric field, wherein the input and output transducers are attached to the piezoelectric substrate; and

(d) an operating system in communication with the input and output transducers.

57. (ORIGINAL) The system of claim 56, wherein the operating system detects binding of a target substance in real-time.

58. (ORIGINAL) The system of claim 56, wherein the interaction of the first target substance with the first binding agent produces the second target substance.

59. (ORIGINAL) A system for inline detection of a scaling agent comprising:

a detector comprising a surface modified with a binding agent for binding a scaling agent, wherein the detector is in fluid communication with a pulping system.

60. (ORIGINAL) The system of claim 59, wherein the detector is selected from the group consisting of an optical detection device, MEMS detection device, nanoparticle detection device, and an acoustic wave detection device.

61. (ORIGINAL) The system of claim 59, wherein the detector comprises a piezoelectric substrate surface-modified with a binding agent for binding a scaling agent and a pair of transducers coupling the piezoelectric substrate to an operating system.

62. (ORIGINAL) The system of claim 59, wherein the scaling agent comprises hexenuronic acid, catechol, aluminum sulfate, derivatives thereof, or combinations thereof.

63. (ORIGINAL) The system of claim 59, wherein the system is configured to detect the scaling agent in real-time.

64. (ORIGINAL) A method for detecting a scaling agent in a pulping system comprising:

contacting a detector with a sample from the pulping system, wherein the detector comprises:

a piezoelectric substrate surface-modified with a binding agent for binding the scaling agent and

a pair of transducers coupling the piezoelectric substrate to an operating system,

wherein a change in frequency of the piezoelectric substrate is detected when the scaling agent interacts with the binding agent.

65. (ORIGINAL) The method of claim 64, wherein the scaling agent comprises hexenuronic acid, catechol, aluminum sulfate, or combinations thereof.

66. (ORIGINAL) The method of claim 65, wherein the binding agent comprises a antibody.

67. (ORIGINAL) A system for detecting one or more target substances comprising:

(a) a detector;

(b) a first and a second binding agent attached to a surface of the detector, wherein the first binding agent specifically binds a first target substance and the second binding agent specifically binds a second target agent produced by the interaction of the first target substance with the first binding agent; and

(d) an operating system in communication with the detector.

68. (ORIGINAL) The system of claim 67, wherein the detector is selected from the group consisting of an optical detection device, MEMS detection device, nanoparticle detection device, and an acoustic wave detection device.

69. (ORIGINAL) The system of claim 67, wherein the second target substance comprises a growth factor, differentiation inducing factor, cell adhesion factor, enzyme, lipid, carbohydrate, polypeptide, polynucleotide, antibiotic, pH buffer, acid, base, or a combination thereof.

70. (ORIGINAL) The system of claim 67, wherein the interaction of the first target substance with the first binding agent modifies the first target substance or the interaction of the second target substance with the second binding agent modifies the second target substance.

71. (ORIGINAL) The system of claim 67, wherein the modification is selected from the group consisting of a conformational modification, a structural modification, and a covalent modification.

72. (ORIGINAL) The system of claim 71, wherein the modification renders the first or second binding agent or the first or second target substance unable to interact with the detection system.

73. (ORIGINAL) The system of claim 67, wherein the first or second target is degraded or covalently bound by the first or second binding agent.

74. (ORIGINAL) A pathogen detection system comprising:

(a) a detector;

(b) a binding agent attached to a surface of the detector, wherein the binding agent specifically binds a pathogen or a fragment thereof; and

(c) an operating system in communication with the detector;wherein the pathogen detection system is configured to detect the interaction of the pathogen with the binding agent in real-time.

75. (ORIGINAL) The system of claim 74, wherein the detector is selected from the group consisting of an optical detection device, MEMS detection device, nanoparticle detection device, and an acoustic wave detection device.

76. (ORIGINAL) The system of claim 74, wherein the pathogen comprises bacteria, fungi, protozoa, carcinogens, volatile organic compounds, viruses, prions, parasites, or a combination thereof.

77. (ORIGINAL) The system of claim 74, wherein the pathogen comprises a spore.

78. (ORIGINAL) The system of claim 74, wherein the spore is produced by black mold or Bacillus anthracis.

79. (ORIGINAL) The system of claim 74, wherein the system is in fluid communication with a water distribution system or a heating, ventilating and air-conditioning system.

80. (ORIGINAL) The system of claim 74, wherein the system is in gaseous communication with a water distribution system or a heating, ventilating and air-conditioning system, a wall cavity or an enclosed living space.

81. (ORIGINAL) A piezoelectric array comprising:

a piezoelectric substrate with a plurality of regions surface-modified with a binding agent, wherein each region binds a specific target substance, and wherein the array is configured to detect interaction of more than one target substance with the binding agents.

82. (ORIGINAL) The array of claim 81, wherein the piezoelectric substrate is coupled to an operating system.